PERSPECTIVE, PART III.

POYNTER'S SOUTH KENSINGTON DRAWING-BOOK.

J Maule

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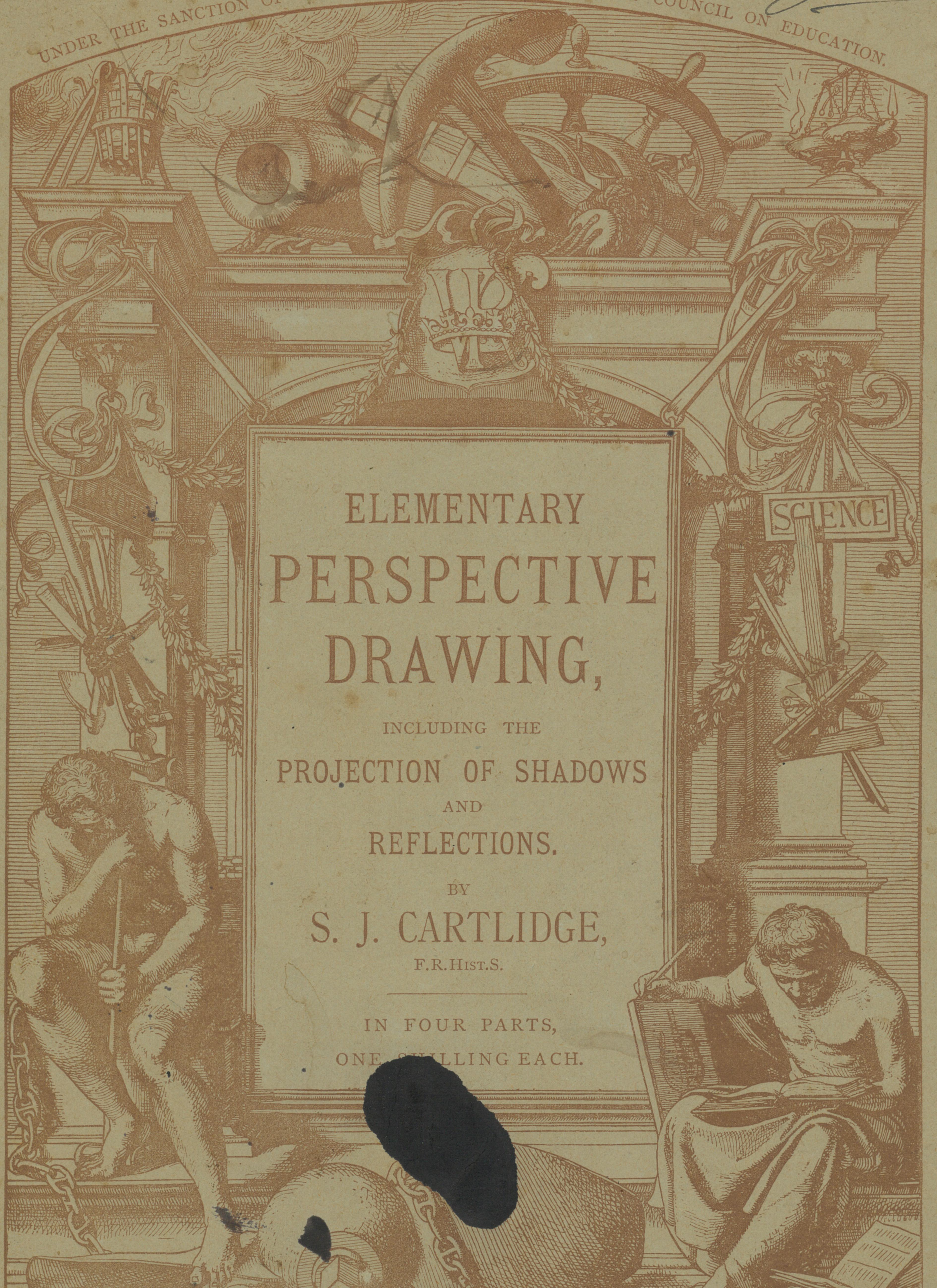

ELEMENTARY

PERSPECTIVE DRAWING,

INCLUDING THE

PROJECTION OF SHADOWS

AND

REFLECTIONS.

BY

S. J. CARTLIDGE,

F.R.Hist.S.

IN FOUR PARTS,

ONE SHILLING EACH.

DESIGN FOR A DIPLOMA FOR NAVAL CONSTRUCTION, BY E. J. POYNTER, R.A.

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C. T. Rickarby September 12th 1892 Richmond

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ELEMENTARY
PERSPECTIVE DRAWING.

BY

S. J. CARTLIDGE, F.R.Hist.S

PART III.

Plate XVII.

IN the preceding division of our study, lines inclined to the G.P. were drawn by making use of *vertical* lines. (See Problems 9, 11, 15, 16, 17, 20, 21, 22 and 23.) We must now consider the method of drawing lines inclined to the G.P., by means of their Vanishing and Measuring Points. These points will usually fall wide of the H.L., and hence are called "*accidental*" vanishing and measuring points.

If we have a line inclined at a certain angle to the G.P., and wish to find its V.P., we must imagine a *vertical plane* to pass *through* the line. For example, in Fig. 22 the block ABCDEF, has its square end A, F, E, C, in a vertical position; and its oblong face ACDB, also in a vertical position. If we draw the diagonal CF, of the square end, it is *contained* in the *vertical plane* of the square end, which is receding from the spectator, to the left. It is, of course, quite obvious that the diagonal C F, is *inclined to the* G.P.. In the same way the diagonal A D, of the *oblong* face is contained in the *vertical plane* of that face, which is vanishing to the right. If we produce CE, and AF, to the H.L., we shall have the vanishing point of two *horizontal lines* which are contained in the *vertical plane* of the *square* end of the block. This V.P. is called the *Original Vanishing Point* of the vertical plane of the end of the block. Through this V.P. a *Vertical Vanishing Line* is drawn, upon which the Vanishing Points of any lines contained in the end of the block, or in a vertical plane passing through the end of the block, will fall. If we produce CF, to meet the Vertical Vanishing Line, its V.P. will be found *below* the H.L. in A.V.P. of C F.

This V.P. is below the H.L. because the line is vanishing in a *downward* direction, *it descends*. The V.P. of A D, would be determined in the same way, viz.:—by producing C D and A B to meet the H.L. in the Original Vanishing Point, drawing the Vertical Vanishing Line through the Original Vanishing Point, and producing A D to meet the Vertical Vanishing Line.

The V.P. of A D would be *above* the H.L. because A D *ascends* from the spectator. If an inclined line has its nearer extremity lower than its farther one, the line *ascends*. If, on the contrary, the *nearer* extremity is higher than the farther one, the line *descends*.

PROBLEM 24. *A right line* 9′ *long, has one extremity upon the* G.P. *at a point* 2′ *to the left of the spectator and* 4′ *within the picture. The line is contained in a vertical plane which recedes from the* P.P. *at an angle of* 50° *to the right. The line is inclined at an angle of* 45° *to the* G.P. *and vanishes upwards from the spectator.*

HAVING found the nearer extremity x, of the line. By drawing an *Original Vanishing Parallel* at *50°* with the P.P. to the right, we find the Original Vanishing Point of the vertical plane containing the line, in Original V.P. 50°. Through Original V.P. 50° draw the V.V.L. (*Vertical Vanishing Line*).

To find the Accidental Vanishing Point of the line. Find Original M.P. 50° by Proposition VII., Page 14.

Proposition IX. *To find the Vanishing Point of an inclined line.* FROM THE ORIGINAL M.P. DRAW A LINE TO MEET THE V.L., PARALLEL TO THE LINE WHOSE V.P. IS REQUIRED.

Then, as the line is inclined at an angle of 45° to the G.P., which is horizontal, draw from Original M.P. 50° to meet the V.V.L., an *Accidental Vanishing Parallel at an angle of 45° with the* H.L.. This gives A.V.P. 45°.

Join x to A.V.P. 45°.

Now that we have the line in its proper direction, it only remains for us to measure it.

Proposition X. *To find the Measuring Point of an inclined line.* UPON THE V.L. SET OFF FROM THE A.V.P. THE LENGTH OF THE ACCIDENTAL VANISHING PARALLEL.

Take then, *Accidental Vanishing Parallel 45°* as radius, and A.V.P. 45° as centre, giving A.M.P. 45° on the V.V.L.. We must now transfer X (Prop. V.) to the P.P. from its M.P.. It will of course be transferred to the P.P. in the Intersecting Line *of the Vertical Plane which contains the line to be measured.*

On reference to **Fig. 22** it will be seen that the intersection of the square end of the block with the P.P. would be found by producing edge F A, (the Ground Intersection of the square end) to meet the G.L.. Through the point so found upon the G.L. the intersection of the square end with the P.P. would be drawn *vertically*, as vertical planes meet each other vertically.

Draw then a Ground Intersection from Original V.P. 50° through x to meet the ground line in I.

Through I, the point in which the Ground Intersection [illegible]s the G.L., draw a *Vertical Intersecting Line.*

[illegible]ansfer x from A.M.P. 45° to its I.L. in X 45°.

[illegible]om X 45° measure the length, 9′, in 9.45°.

Return 9.45°, to A.M.P. 45° and it cuts off 9′ in z.

EXERCISE 51. A right line 7′ long has one extremity upon the G.P. at a point 3′ to the right of the spectator and 3′ within the picture. The line is inclined upwards at an angle of 30° to the G.P. and is contained in a vertical plane which vanishes to the left at an angle of 30° with the P.P..

Fig. 22.

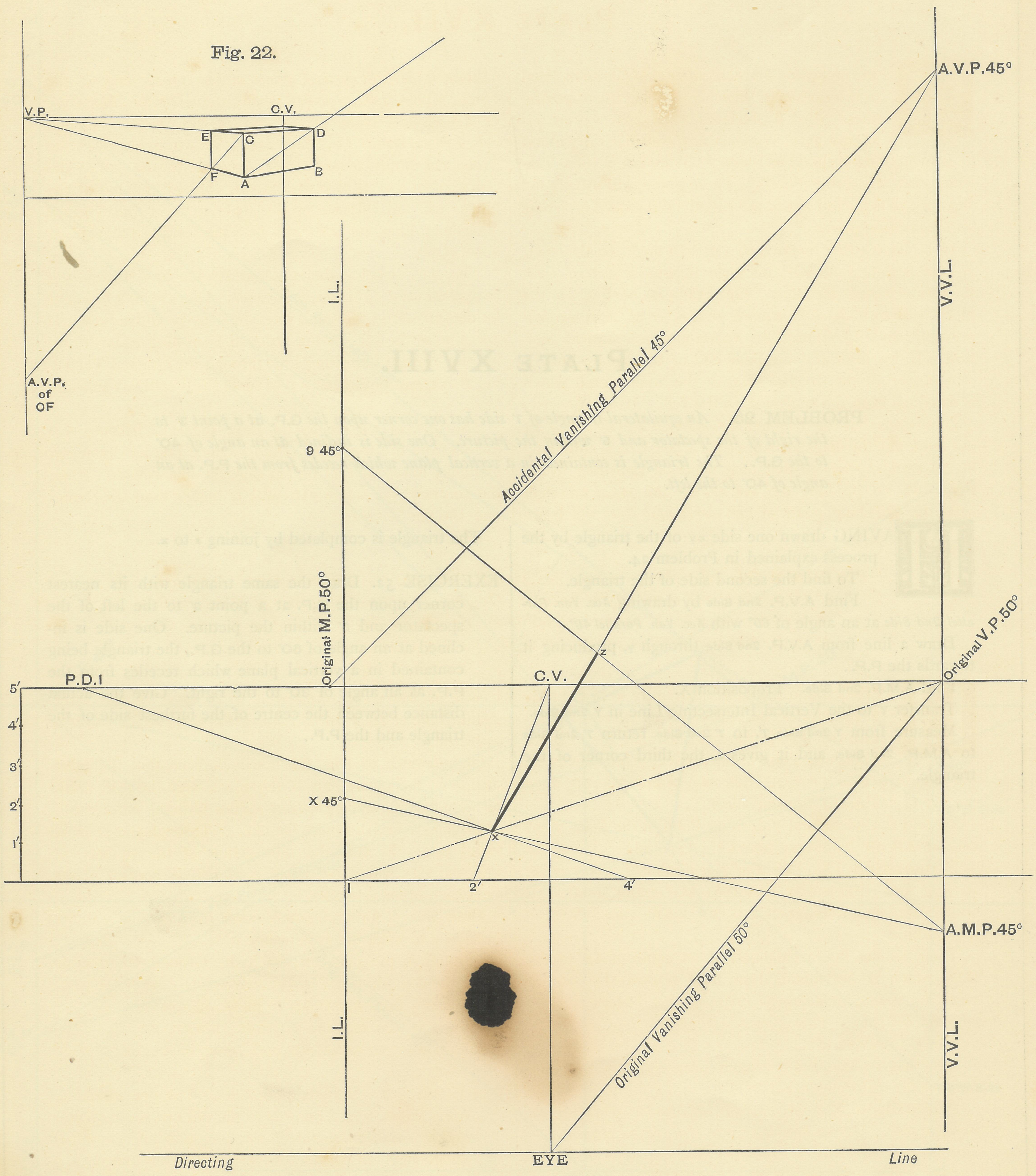

V.P.
C.V.
E
C
D
F
A
B
A.V.P. of CF
A.V.P. 45°
V.V.L.
I.L.
Accidental Vanishing Parallel 45°
9 45°
Original M.P. 50°
C.V.
z
Original V.P. 50°
P.D. 1
5′
4′
3′
2′
1′
X 45°
x
1
2′
4′
A.M.P. 45°
I.L.
Original Vanishing Parallel 50°
V.V.L.
Directing
EYE
Line

PLATE XVIII.

PROBLEM 25. *An equilateral triangle of* 7′ *side has one corner upon the* G.P. *at a point* 3′ *to the right of the spectator and* 5′ *within the picture. One side is inclined at an angle of* 40° *to the* G.P.. *The triangle is contained in a vertical plane which recedes from the* P.P. *at an angle of* 40° *to the left.*

HAVING drawn one side xy of the triangle by the process explained in Problem 24.

To find the second side of the triangle.

Find A.V.P. 2nd Side by drawing *Acc. Van. Parallel 2nd Side* at an angle of 60° with *Acc. Van. Parallel 40°.*

Draw a line from A.V.P. 2nd Side through y, producing it towards the P.P..

Find A.M.P. 2nd Side. Proposition X.

Transfer Y to the Vertical Intersecting Line in Y 2nd Side.

Measure from Y 2nd Side, 7′, to 7′ 2nd Side, return 7′ 2nd Side to A.M.P. 2nd Side, and it gives z, the third corner of the triangle.

The triangle is completed by joining z to x.

EXERCISE 52. Draw the same triangle with its nearest corner upon the G.P. at a point 3′ to the left of the spectator and 5′ within the picture. One side is inclined at an angle of 60° to the G.P., the triangle being contained in a vertical plane which recedes from the P.P. at an angle of 30° to the right. Give the actual distance between the centre of the furthest side of the triangle and the P.P..

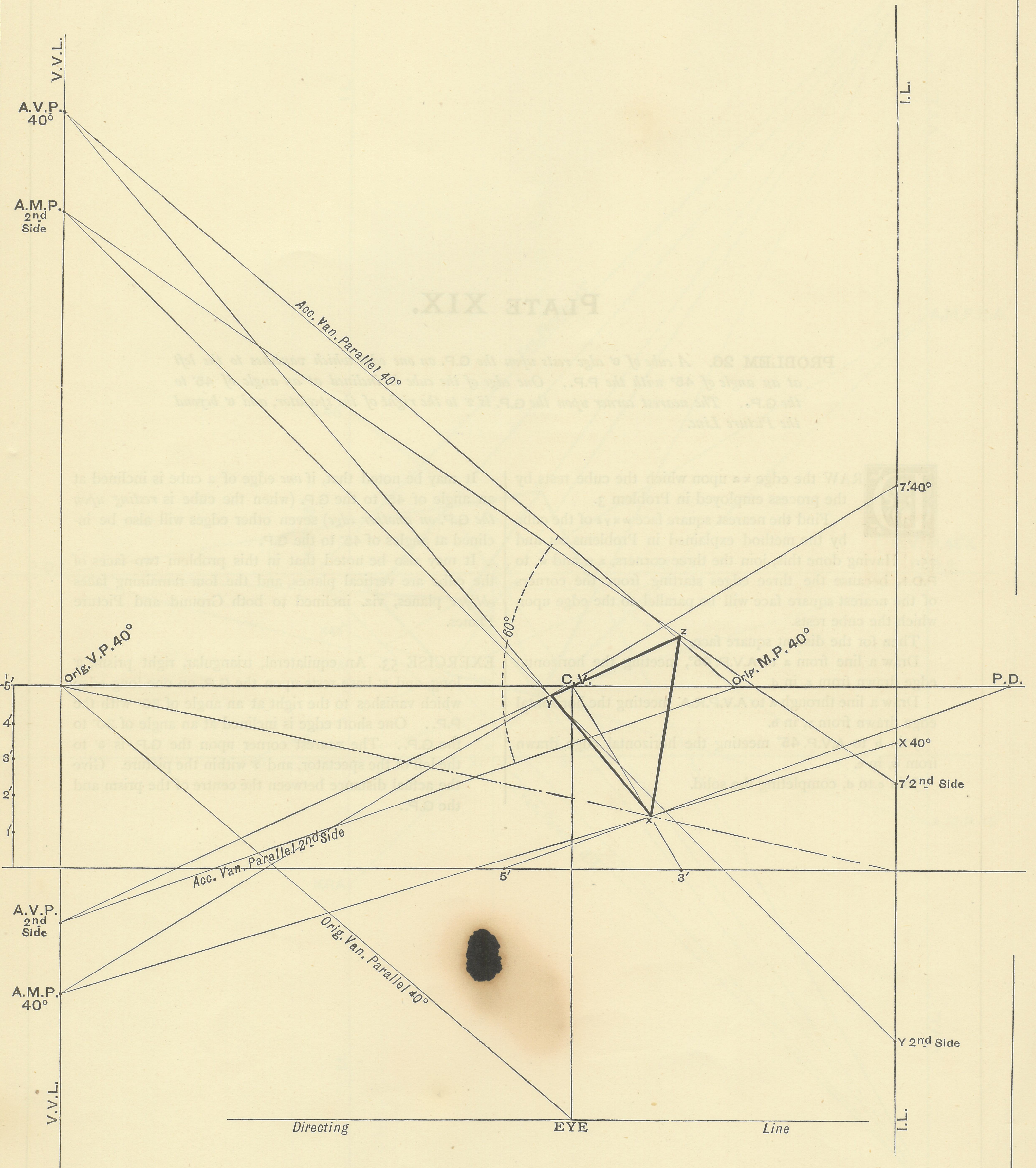

V.V.L.
A.V.P. 40°
A.M.P. 2nd Side
Acc. Van. Parallel 40°
I.L.
7′ 40°
60°
Orig. V.P 40°
C.V.
Orig. M.P. 40°
P.D.
z
y
x
X 40°
Y′ 2nd Side
5′
4′
3′
2′
1′
5′
3′
Acc. Van. Parallel 2nd Side
A.V.P. 2nd Side
A.M.P. 40°
Orig. Van. Parallel 40°
Y 2nd Side
V.V.L.
Directing
EYE
Line
I.L.

PLATE XIX.

PROBLEM 26. *A cube of* 6′ *edge rests upon the* G.P. *on one edge which vanishes to the left at an angle of* 45° *with the* P.P.. *One edge of the cube is inclined at an angle of* 45° *to the* G.P.. *The nearest corner upon the* G.P. *is* 2′ *to the right of the spectator, and* 6′ *beyond the Picture Line.*

DRAW the edge x a upon which the cube rests by the process employed in Problem 3.

Find the nearest square face w x y z of the cube by the method explained in Problems 24 and 25. Having done this, join the three corners, z, y, and w, to P.D.1, because the three edges starting from the corners of the nearest square face will be parallel to the edge upon which the cube rests.

Then for the distant square face.

Draw a line from a to A.V.P. 45°, meeting the horizontal edge drawn from z, in d.

Draw a line through a to A.V.P.R.A. meeting the horizontal edge drawn from y, in b.

Join b to A.V.P. 45° meeting the horizontal edge drawn from w, in c.

Join c to d, completing the solid.

It may be noted that, if *one* edge of a cube is inclined at an angle of 45° to the G.P. (when the cube is *resting upon the* G.P. *on another edge*) seven other edges will also be inclined at angles of 45° to the G.P.

It may also be noted that in this problem two faces of the cube are vertical planes, and the four remaining faces *oblique* planes, viz. inclined to both Ground and Picture Planes.

EXERCISE 53. An equilateral, triangular, right prism, 8′ long, and 5′ base rests upon the G.P. on one long edge which vanishes to the right at an angle of 30° with the P.P.. One short edge is inclined at an angle of 30° to the G.P.. The nearest corner upon the G.P. is 3′ to the left of the spectator, and 7′ within the picture. Give the actual distance between the centre of the prism and the G.P..

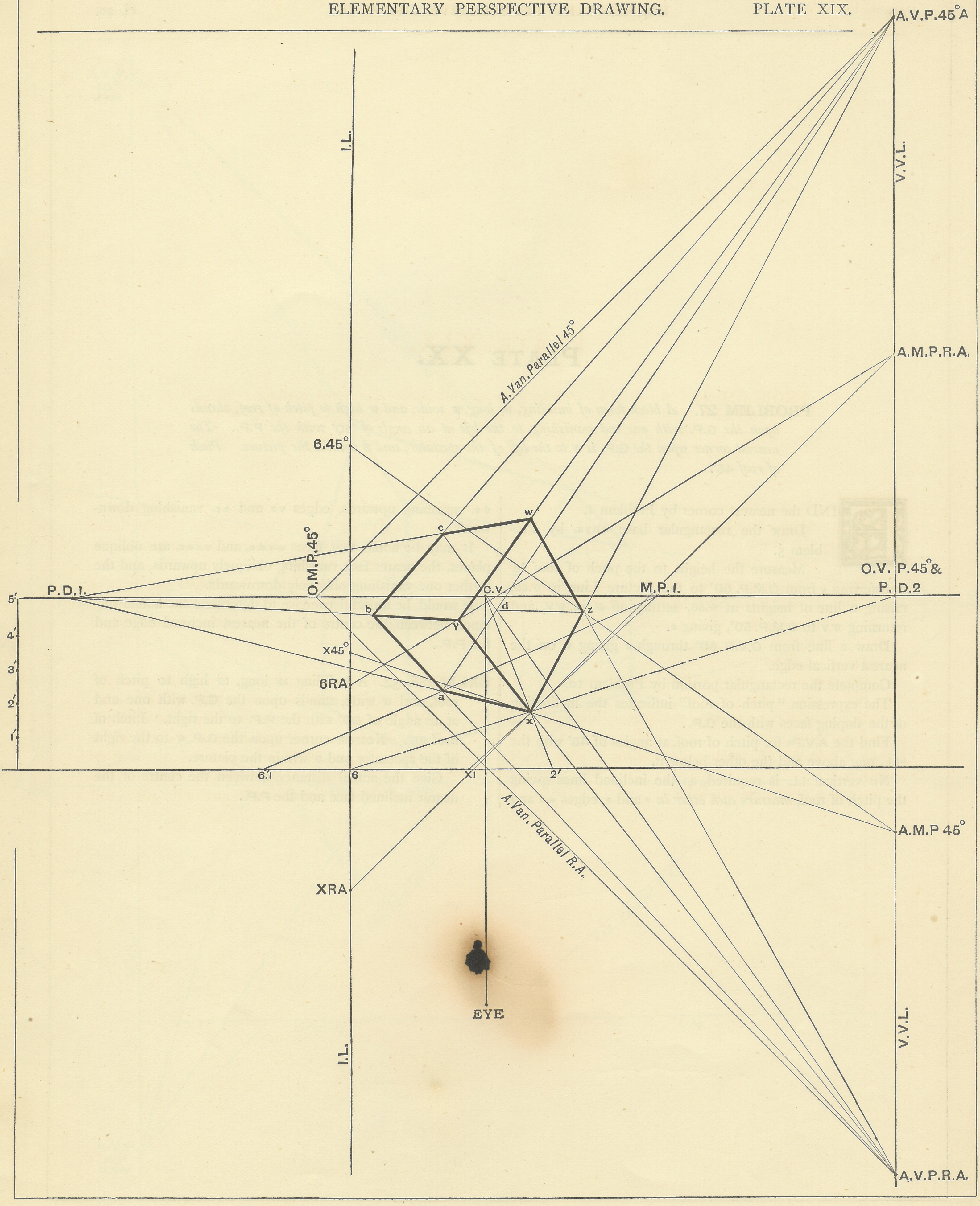

A.V.P.45°A
V.V.L.
I.L.
A.Van. Parallel 45°
A.M.P.R.A.
6.45°
w
c
O.M.P.45°
O.V. P.45°&
P.D.1.
C.V.
M.P.1.
P. D.2
5′
b
d
z
y
4′
X45°
3′
6RA
a
x
2′
1′
6.1
6
X1
2′
A.Van. Parallel R.A.
A.M.P 45°
XRA
EYE
I.L.
V.V.L.
A.V.P.R.A.

PLATE XX.

PROBLEM 27. *A block form of building,* 15′ *long,* 9′ *wide, and* 9′ *high to pitch of roof, stands upon the* G.P. *with one end vanishing to the left at an angle of* 50° *with the* P.P.. *The nearest corner upon the* G.P. *is* 3′ *to the left of the spectator, and* 3′ *within the picture. Pitch of roof* 45°.

FIND the nearest corner by Problem 1.

Draw the rectangular base a b y x, by Problem 5.

Measure the height to the pitch of roof by transferring y from O.M.P. 50° to the Picture Line in 9′.50, raising a line of heights at 9′.50, setting off 9′ in 9′ V, and returning 9′ V to O.M.P. 50°, giving z.

Draw a line from O.V.P. 50° through z giving w on the nearest vertical edge.

Complete the rectangular portion by Problem 10.

The expression "pitch of roof" indicates the inclination of the sloping faces with the G.P..

Find the A.V.Ps for pitch of roof, at angles of 45° with the H.L. one above and the other below it.

No vertical I.L. is required, as the inclined lines giving the pitch of roof, *measure each other in* v and e, edges w v and d e, vanishing upwards, edges v z and e c, vanishing downwards.

It may be noted that faces w v d e, and v z e c, are oblique planes, the nearer face vanishing obliquely upwards, and the further one vanishing obliquely downwards.

It would be a useful exercise to determine the actual distance between the centre of the nearest inclined edge and the P.P..

EXERCISE 54. A building 14′ long, 10′ high to pitch of roof, and 6′ wide, stands upon the G.P. with one end at an angle of 30° with the P.P. to the right. Pitch of roof 35°. Nearest corner upon the G.P. 4′ to the right of the spectator and 9′ within the picture.

Give the actual distance between the centre of the nearer inclined face and the P.P..

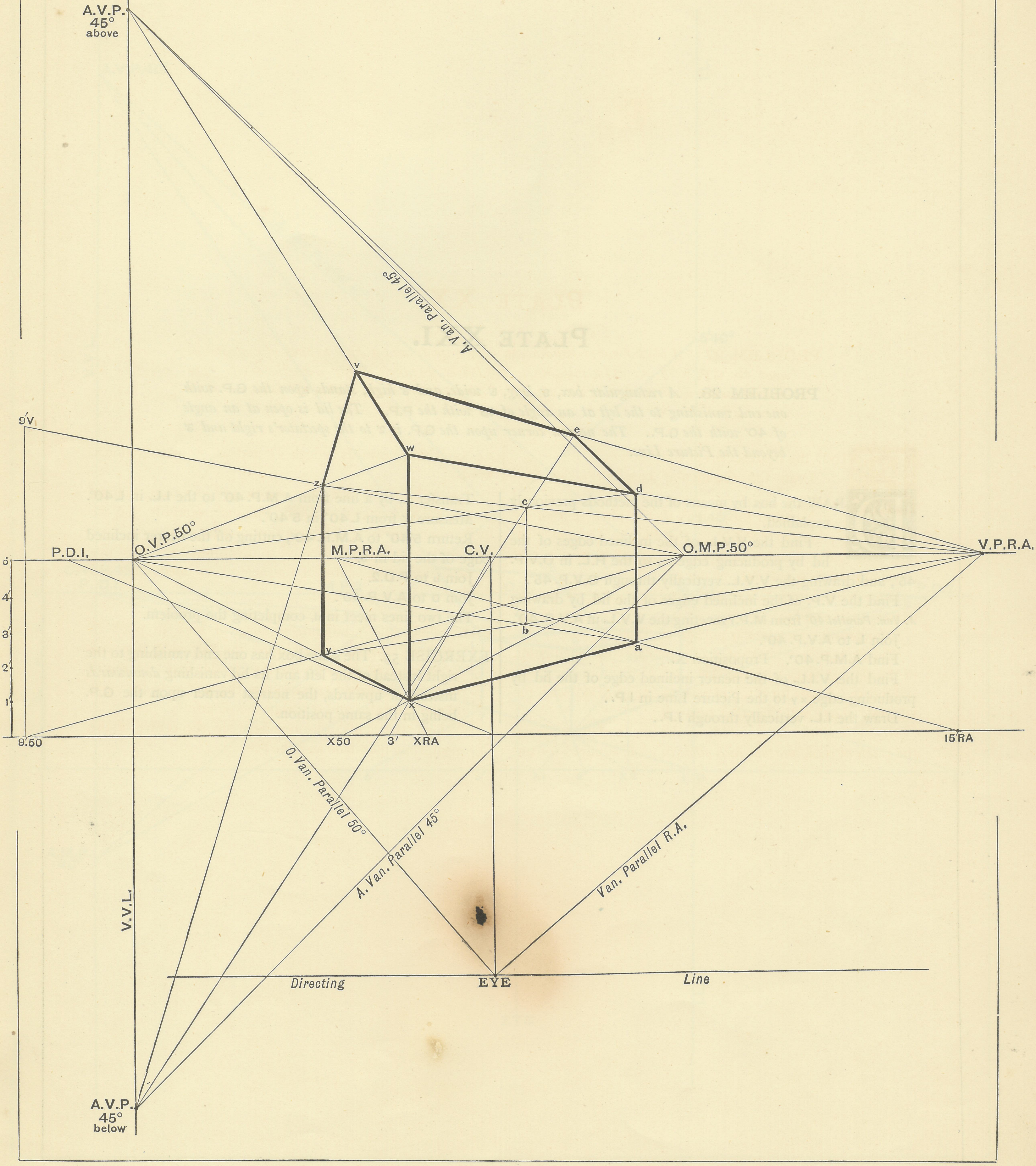

A.V.P.
45°
above
A. Van. Parallel 45°
v
9'V
e
w
z
d
c
P.D.I.
O.V.P.50°
M.P.R.A.
C.V.
O.M.P.50°
V.P.R.A.
5'
4'
3'
2'
1'
b
y
a
x
9.50
X50
3'
XRA
15 RA
O. Van. Parallel 50°
A. Van. Parallel 45°
Van. Parallel R.A.
V.V.L.
Directing
EYE
Line
A.V.P.
45°
below

PLATE XXI.

PROBLEM 28. *A rectangular box,* 9′ *long,* 5′ *wide, and* 3′ *high, stands upon the* G.P. *with one end vanishing to the left at an angle of* 45° *with the* P.P.. *The lid is open at an angle of* 40° *with the* G.P.. *The nearest corner upon the* G.P. *is* 2′ *to the spectator's right and* 3′ *beyond the Picture Line.*

DRAW the box by means of the methods previously explained.

Find the V.V.L. of the inclined edges of the lid by producing edge x y to the H.L. in O.V.P. 45°, and drawing the V.V.L. vertically through O.V.P. 45°.

Find the V.P. of the inclined edges of the lid by drawing *A. Van. Parallel 40°* from M.P.I meeting the V.V.L. in A.V.P. 40°.

Join L to A.V.P. 40°.

Find A.M.P. 40°. Proposition X.

Find the V.I.L. of the nearer inclined edge of the lid by producing edge x y to the Picture Line in I.P..

Draw the I.L. vertically through I.P..

Transfer L, by a line from A.M.P. 40° to the I.L. in L 40°.

Measure 5′ from L 40° in 5′ 40°.

Return 5′ 40° to A.M.P. 40°, cutting off the nearer inclined edge of the lid in b.

Join b to P.D.2.

Join D to A.V.P. 40°.

The two lines meet in d, completing the problem.

EXERCISE 55. The same box has one end vanishing to the right instead of the left and its lid vanishing *downwards* instead of upwards, the nearest corner upon the G.P. being in the same position.

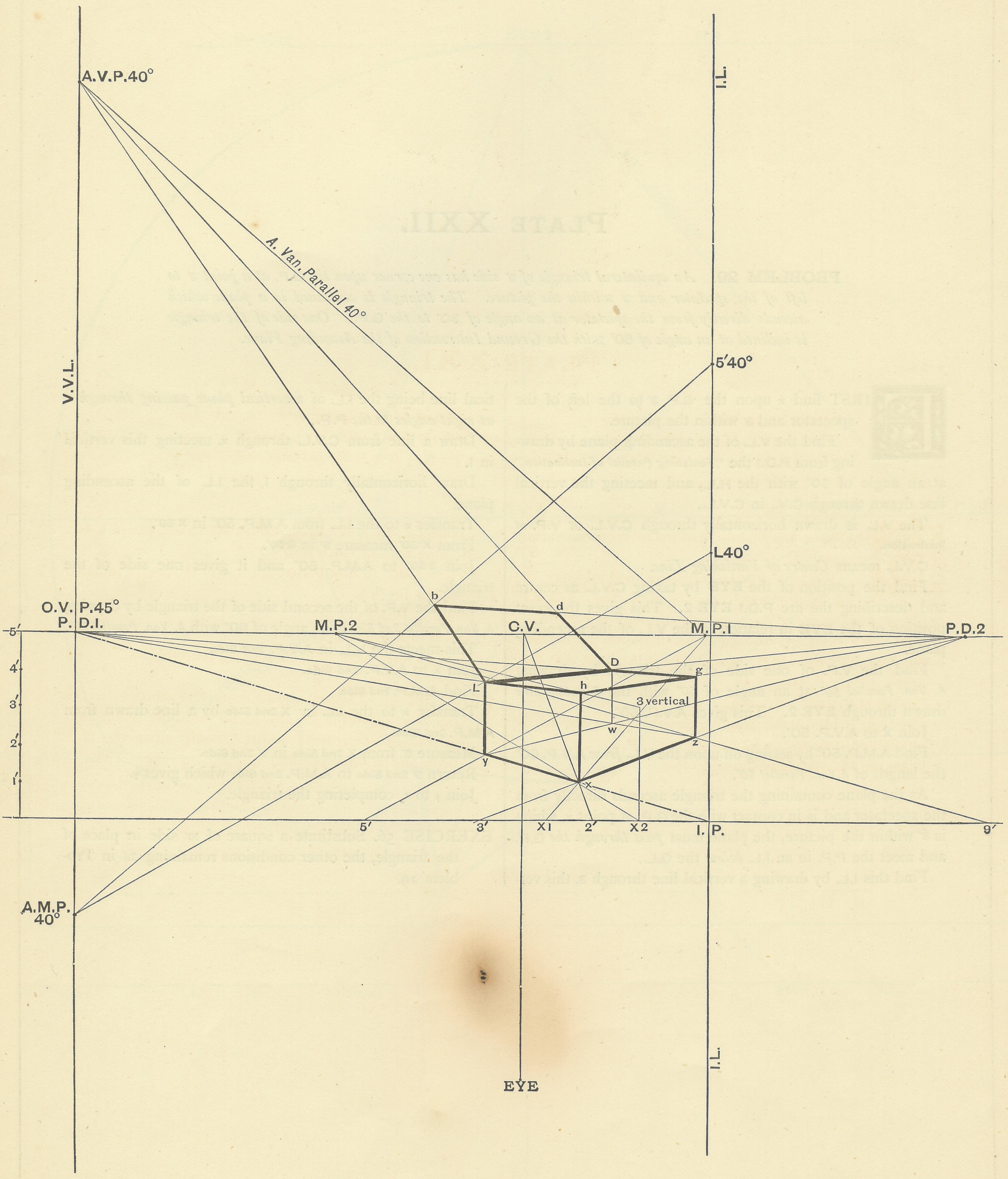

A.V.P.40°
I.L.
A. Van. Parallel 40°
V.V.L.
5'40°
L40°
O.V. P.45°
P. D.I.
M.P.2
C.V.
M.P.I
P.D.2
b
d
D
L
h
g
3 vertical
w
z
y
x
5'
4'
3'
2'
1'
5'
3'
X1
2'
X2
I. P.
9'
A.M.P. 40°
EYE
I.L.

PLATE XXII.

PROBLEM 29. *An equilateral triangle of* 9′ *side has one corner upon the* G.P. *at a point* 3′ *to left of the spectator and* 3′ *within the picture. The triangle is contained in a plane which ascends directly from the spectator at an angle of* 30° *to the* G.P.. *One side of the triangle is inclined at an angle of* 50° *with the Ground Intersection of the Ascending Plane.*

FIRST find x upon the G.P. 3′ to the left of the spectator and 3′ within the picture.

Find the V.L. of the ascending plane by drawing from P.D.1 the *"Vanishing Parallel of Inclination"* at an angle of 30° with the H.L., and meeting the vertical line drawn through C.V., in C.V.L..

The V.L. is drawn horizontally through C.V.L. or V.P. of inclination.

C.V.L. means *Centre of Vanishing Line.*

Find the position of the EYE by taking C.V.L. as centre and describing the arc P.D.1 EYE 2. This gives the exact position of the EYE in relation to the V.L. of the ascending plane.

Find the V.P. of one side of the triangle by drawing *A. Van. Parallel 50°* at an angle of *50°* with the *Directing Line* drawn through EYE 2. This gives A.V.P. 50°.

Join X to A.V.P. 50°.

Find A.M.P. 50° by setting off upon the V.L. *from* A.V.P. 50° the length of *A. Van. Parallel 50°.*

As the plane containing the triangle ascends directly from the spectator and is in contact with the G.P. at point x, which is 3′ within the picture, the plane must *pass through the* G.P. and meet the P.P. in an I.L. *below* the G.L..

Find this I.L. by drawing a vertical line through 3, this vertical line being the I.L. of a *vertical plane passing through* x *at right angles to the* P.P..

Draw a line from C.V.L. through x, meeting this vertical in I.

Draw horizontally through I, the I.L. of the ascending plane.

Transfer x to the I.L. from A.M.P. 50° in X 50°.

From X 50° measure 9′ in 9·50°.

Join 9·50° to A.M.P. 50° and it gives one side of the triangle.

Find the V.P. of the second side of the triangle by drawing *A. Van. Parallel 2nd Side* at an angle of 60° with *A. Van. Parallel 50°.*

This meets the V.L. in A.V.P. 2nd Side.

Join X to A.V.P. 2nd Side.

Find A.M.P. 2nd Side.

Transfer x to the I.L. in X 2nd Side by a line drawn from A.M.P. 2nd Side.

Measure 9′ from X 2nd Side in 9′ 2nd Side.

Return 9′ 2nd Side to A.M.P. 2nd Side which gives y.

Join y to z, completing the triangle.

EXERCISE 56. Substitute a square of 10′ side in place of the triangle, the other conditions remaining as in Problem 29.

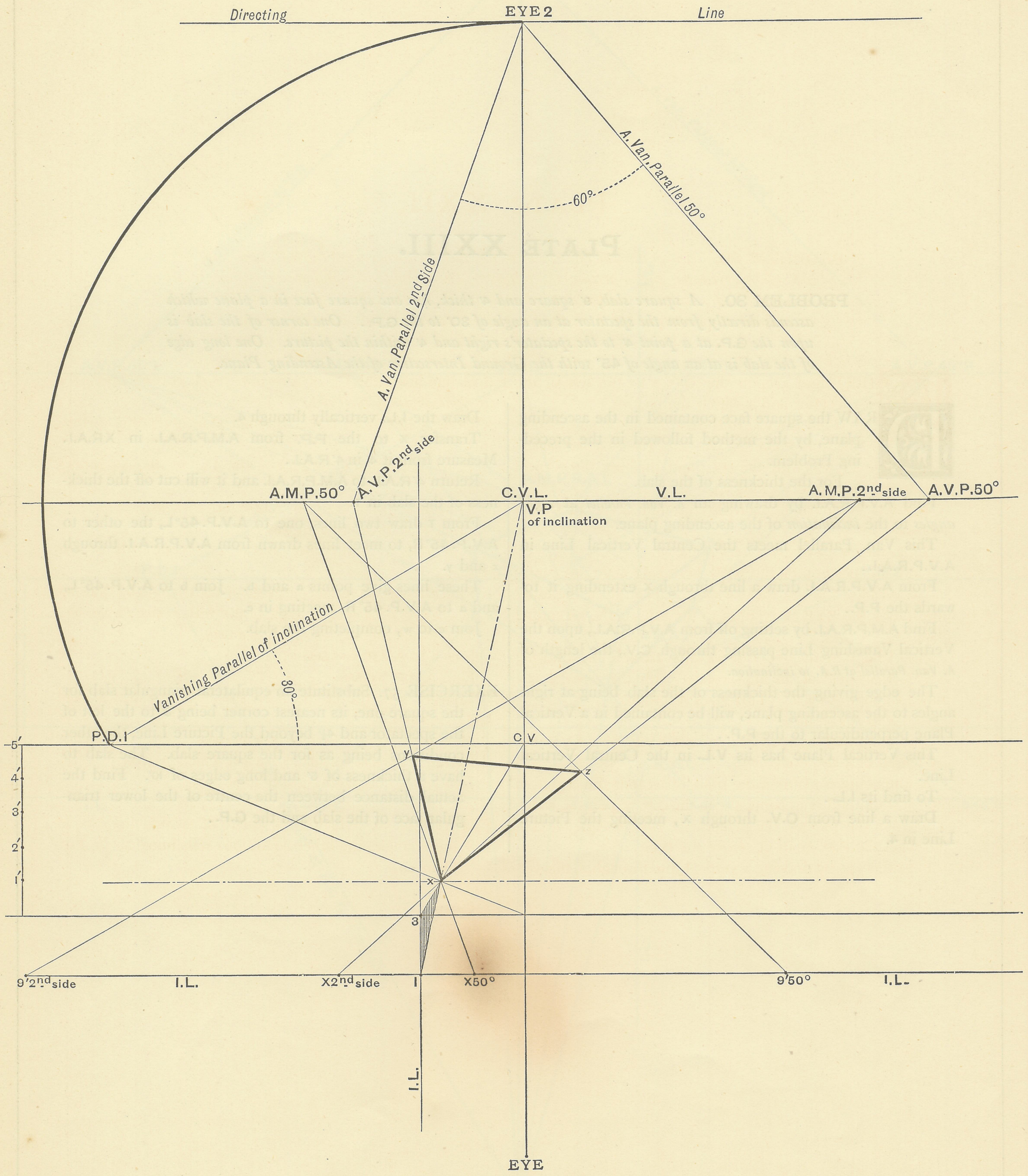

Directing
EYE 2
Line
A.Van.Parallel 50°
60°
A.Van.Parallel 2nd Side
A.V.P.2nd side
A.M.P.50°
C.V.L.
V.L.
A.M.P.2nd side
A.V.P.50°
V.P
of inclination
Vanishing Parallel of inclination
30°
P.D.1
5'
4'
3'
2'
1'
C.V
y
z
x
3
9'2nd side
I.L.
X2nd side
I
X50°
9'50°
I.L.
I.L.
EYE

PLATE XXIII.

PROBLEM 30. *A square slab,* 9′ *square and* 4′ *thick, has one square face in a plane which ascends directly from the spectator at an angle of* 30° *to the* G.P.. *One corner of the slab is upon the* G.P. *at a point* 4′ *to the spectator's right and* 4′ *within the picture. One long edge of the slab is at an angle of* 45° *with the Ground Intersection of the Ascending Plane.*

DRAW the square face contained in the ascending plane, by the method followed in the preceding Problem.

For the thickness of the slab.

Find A.V.P.R.A.I. by drawing an *A. Van. Parallel* at *right angles* to the *inclination* of the ascending plane.

This Van. Parallel meets the Central Vertical Line in A.V.P.R.A.I..

From A.V.P.R.A.I. draw a line through X extending it towards the P.P..

Find A.M.P.R.A.I. by setting off from A.V.P.R.A.I., upon the Vertical Vanishing Line passing through C.V., the length of *A. Van. Parallel at R.A. to inclination.*

The edge giving the thickness of the slab being at right angles to the ascending plane, will be contained in a Vertical Plane perpendicular to the P.P..

This Vertical Plane has its V.L. in the Central Vertical Line.

To find its I.L..

Draw a line from C.V. through X, meeting the Picture Line in 4.

Draw the I.L. vertically through 4.

Transfer X to the P.P. from A.M.P.R.A.I. in XR.A.I. Measure from it 4′ in 4′R.A.I..

Return 4′R.A.I. to A.M.P.R.A.I. and it will cut off the thickness of the slab in T.

From T draw two lines, one to A.V.P. 45° L, the other to A.V.P. 45° R, to meet lines drawn from A.V.P.R.A.I. through Z and Y.

These lines give points a and b. Join b to A.V.P. 45° L, and a to A.V.P. 45° R, meeting in c.

Join c to w, completing the slab.

EXERCISE 57. Substitute an equilateral triangular slab for the square one, its nearest corner being 3′ to the left of the spectator and 4½′ beyond the Picture Line, the other conditions being as for the square slab. The slab to have a thickness of 5′ and long edges of 10′. Find the actual distance between the centre of the lower triangular face of the slab and the G.P..

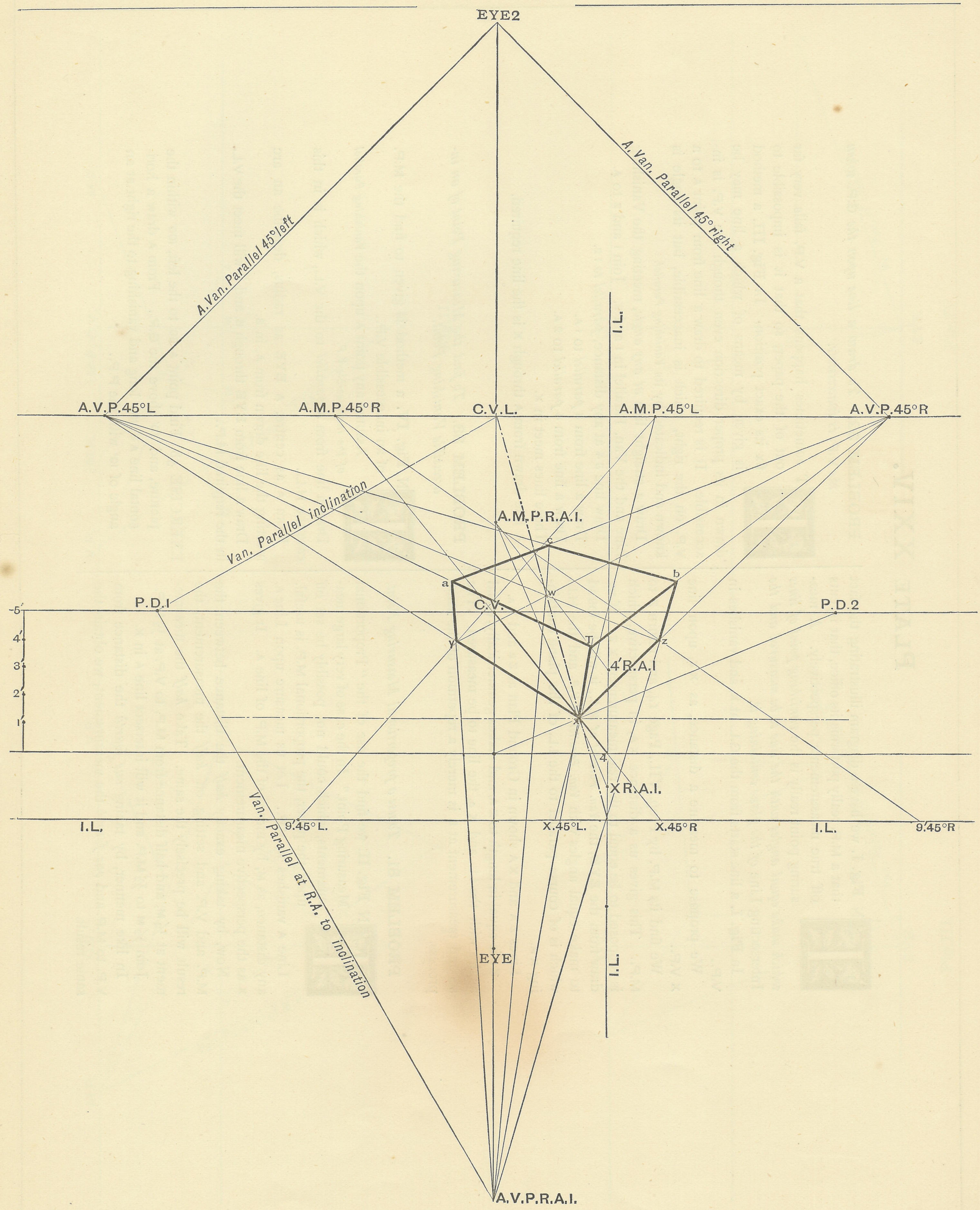

EYE2
A. Van. Parallel 45° left
A. Van. Parallel 45° right
I.L.
A.V.P.45°L
A.M.P.45°R
C.V.L.
A.M.P.45°L
A.V.P.45°R
Van. Parallel inclination
A.M.P.R.A.I.
c
a
b
w
P.D.I
C.V.
P.D.2
5'
4'
3
2
1
y
z
T
4'R.A.I
4
X.R.A.I.
Van. Parallel at R.A. to inclination
I.L.
9.45°L.
X.45°L.
X.45°R
I.L.
9.45°R
EYE
I.L.
A.V.P.R.A.I.

PLATE XXIV.

IN **Fig. I.** we have a diagram illustrating the fact that a M.P. really performs its office, that is, cuts off true measurements perspectively. A measuring point really is the *vanishing point of lines which make equal angles with the line to be measured and the* Intersecting Line *of the plane containing it.*

In **Fig. I.** a line starts from the G.L. at X, and vanishes in V.P..

We propose to measure a distance, as X Z, upon line X V.P..

We find its M.P. by Prop. VII., Page 14, and return Z to M.P.. This gives us a distance X A, in perspective, which is supposed to be equal to the real measurement X Z. If we draw from the **EYE**, the *Van. Parallel of M.P.*, it will be found to make equal angles with *Van. Parallel of V.P.* and the H.L. which is of course parallel to the I.L. of the plane containing X A.

Lines Z A and X A shown in Ground Plan at Z a and X a.

Z a is equal in length to Z A, and makes geometrically, equal angles with the I.L. and X a, the line to be measured. The second measurement at B is merely a repetition of the same process.

PROBLEM 31. *To use a proportional Measuring Point.*

IN **Fig. II.** we find the use of the "Proportional Measuring Point." In the case of very large measurements, which could not possibly be set off upon the paper, the proportional M.P. is useful.

Line A vanishes in V.P.. Let us measure upon Line A, any distance, as M, by means of the M.P. of line A. It gives X as the perspective measurement.

Now, by taking exactly *half* the distance between the M.P. and V.P. and setting off *half* the measurement, the result will be precisely the same. Take *half* the measurement at ½ M, and half distance from M.P. to V.P. at ½ M.P..

Join ½ M to ½ M.P. and it will intersect line A in X.

In like manner, by taking *one fourth* the distance from V.P. to M.P. and *one fourth* the measurement, we obtain the same result.

PROBLEM 32. *To draw a line upon the* G.P. *when the* V.P. *is inaccessible.*

IT sometimes happens that a V.P. falls very far out of the paper, so that it is impossible to fix its exact position. In **Fig. III.** a method is given by means of which a line may be drawn in its proper direction even though the V.P. is inaccessible. It is required to draw a line from point A to a V.P. on the right, which is inaccessible, but its angle is known and indicated by its *Vanishing Parallel.*

Draw a straight line *at any angle*, meeting the Vanishing Line and the Van. Parallel in 1 and 2. Join 1 and 2 to A.

Draw line 3 4 at any distance, *parallel to* 1 2.

Draw a line from 3 *parallel* to 1 A.

Draw a line from 4 *parallel* to 2 A.

These lines meet in X.

A line drawn from A through X is the line required.

PROBLEM 33. *To find the Measuring Point of an inaccessible Vanishing Point.*

IN **Fig. IV.** a method is given to find the M.P. of an inaccessible V.P..

Assume any point A upon the *Vanishing Parallel of the inaccessible V.P.*

Draw a line from A *parallel* to the V.L., which is in this case the H.L..

From A as centre, A **EYE** as radius, describe an arc meeting the line drawn from A, in B.

Draw a line from **EYE** through B, and it will meet the V.L. in the required M.P..

EXERCISE 58. Find point A, 50′ to the left, 100′ within the picture, and 70′ above the G.P.. From A draw a horizontal line A B, 100′ long and vanishing to the right at an angle of 10° with the P.P..

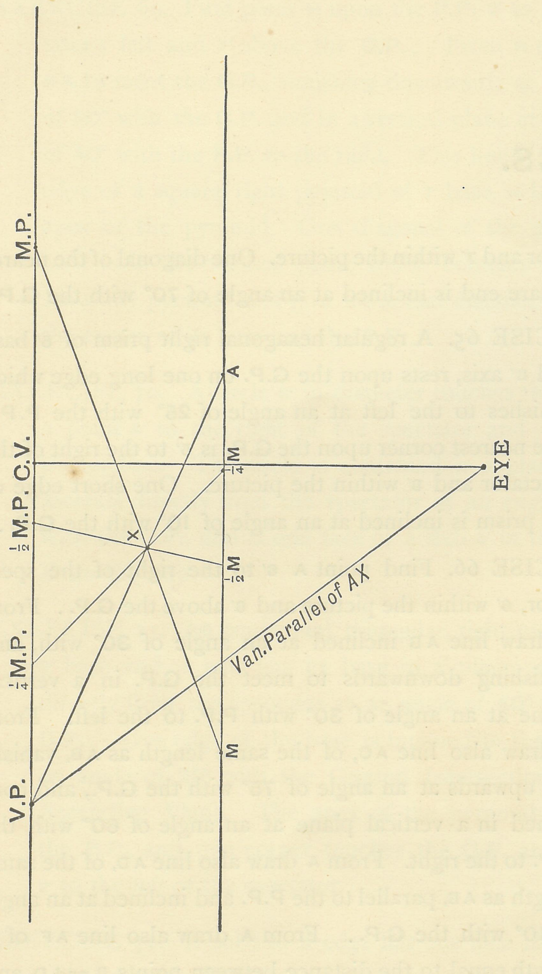


Fig. II.

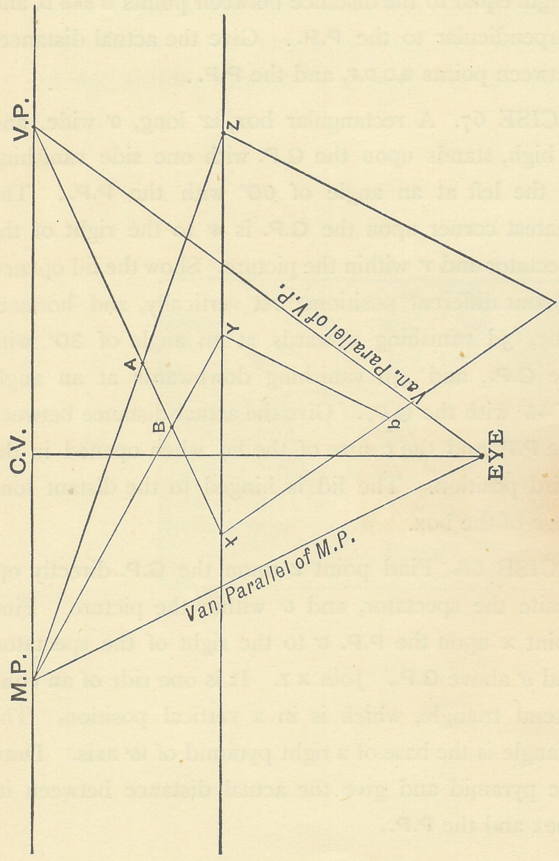


Fig. I.

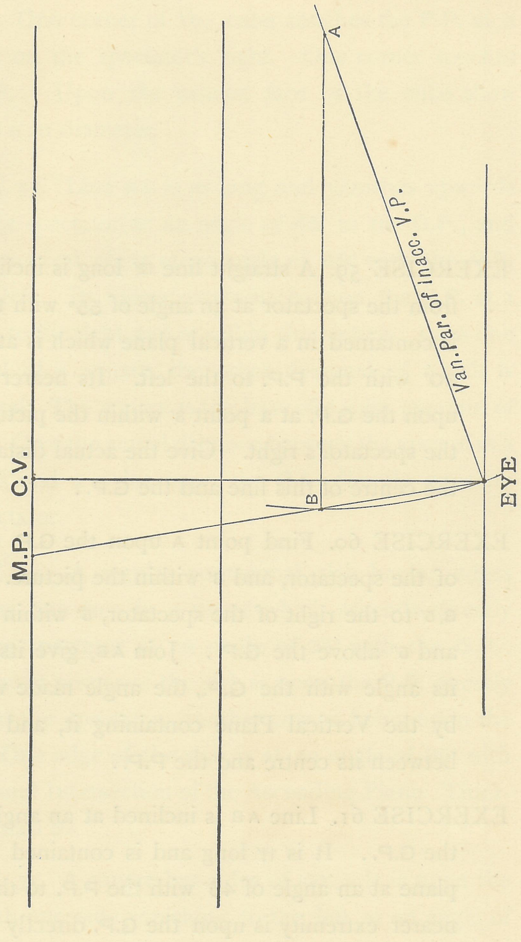


Fig. IV.

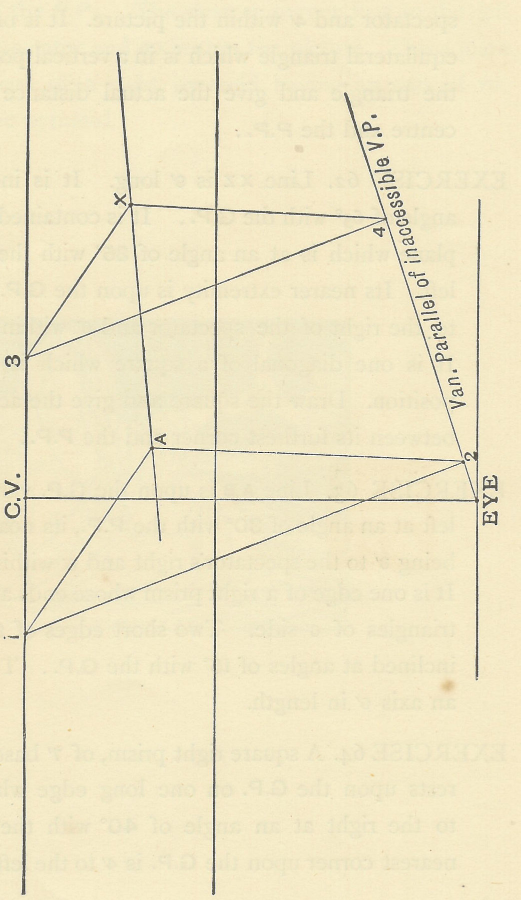


Fig. III.

EXERCISES.

EXERCISE 59. A straight line 12′ long is inclined upwards from the spectator at an angle of 55° with the G.P.. It is contained in a vertical plane which is at an angle of 30° with the P.P. to the left. Its nearer extremity is upon the G.P. at a point 3′ within the picture and 5′ on the spectator's right. Give the actual distance between the centre of this line and the G.P..

EXERCISE 60. Find point A upon the G.P. 3′ to the left of the spectator, and 3′ within the picture. Find point B, 5′ to the right of the spectator, 5′ within the picture, and 5′ above the G.P.. Join A B, give its true length, its angle with the G.P., the angle made with the P.P. by the Vertical Plane containing it, and the distance between its centre and the P.P..

EXERCISE 61. Line A B is inclined at an angle of 10° with the G.P.. It is 11′ long and is contained in a vertical plane at an angle of 45° with the P.P. to the right. Its nearer extremity is upon the G.P. directly opposite the spectator and 4′ within the picture. It is one side of an equilateral triangle which is in a vertical position. Draw the triangle and give the actual distance between its centre and the P.P..

EXERCISE 62. Line X Z is 9′ long. It is inclined at an angle of 65° with the G.P.. It is contained in a vertical plane which is at an angle of 35° with the P.P. to the left. Its nearer extremity is upon the G.P. at a point 2′ to the right of the spectator and 6′ within the picture. It is one diagonal of a square which is in a vertical position. Draw the square and give the actual distance between its furthest corner and the P.P..

EXERCISE 63. Line A B is upon the G.P. vanishing to the left at an angle of 30° with the P.P., its nearer extremity being 3′ to the spectator's right and 6′ within the picture. It is one edge of a right prism whose ends are equilateral triangles of 6′ side. Two short edges of the prism are inclined at angles of 15° with the G.P.. The prism has an axis 9′ in length.

EXERCISE 64. A square right prism, of 7′ base and 10′ axis, rests upon the G.P. on one long edge which vanishes to the right at an angle of 40° with the P.P.. The nearest corner upon the G.P. is 4′ to the left of the spectator and 7′ within the picture. One diagonal of the nearer square end is inclined at an angle of 70° with the G.P..

EXERCISE 65. A regular hexagonal right prism of 5′ base and 11′ axis, rests upon the G.P. on one long edge which vanishes to the left at an angle of 25° with the P.P.. The nearest corner upon the G.P. is 5′ to the right of the spectator and 8′ within the picture. One short edge of the prism is inclined at an angle of 10° with the G.P..

EXERCISE 66. Find point A 6′ to the right of the spectator, 6′ within the picture and 6′ above the G.P.. From A draw line A B inclined at an angle of 30° with, and vanishing downwards to meet the G.P. in a vertical plane at an angle of 30° with P.P. to the left. From A draw also line A C, of the same length as A B, vanishing upwards at an angle of 75° with the G.P., and contained in a vertical plane at an angle of 60° with the P.P. to the right. From A draw also line A D, of the same length as A B, parallel to the P.P. and inclined at an angle of 10° with the G.P.. From A draw also line A F of a length equal to the distance between points B and D, and perpendicular to the P.P.. Give the actual distances between points B,C,D,F, and the P.P..

EXERCISE 67. A rectangular box, 12′ long, 9′ wide, and 6′ high, stands upon the G.P. with one side vanishing to the left at an angle of 60° with the P.P.. The nearest corner upon the G.P. is 4′ to the right of the spectator and 7′ within the picture. Show the lid opened in four different positions; 1st vertically, 2nd horizontally, 3d vanishing upwards at an angle of 30° with the G.P., and 4th vanishing downwards at an angle of 45° with the G.P.. Give the actual distance between the P.P. and the centre of the lid when opened in the third position. The lid is hinged to the distant long edge of the box.

EXERCISE 68. Find point Z upon the G.P. directly opposite the spectator, and 6′ within the picture. Find point X upon the P.P. 8′ to the right of the spectator, and 8′ above G.P.. Join X Z. It is one side of an equilateral triangle, which is in a vertical position. The triangle is the base of a right pyramid of 15′ axis. Draw the pyramid and give the actual distance between its apex and the P.P..

EXERCISE 69. Find point H upon the P.P. 2′ to the spectator's left and 7′ above the G.P.. From H draw line H K to meet the G.P., vanishing downwards at an angle of 50° with the G.P. and in a vertical plane at an angle of 40° with the P.P. to the right. This line is one long edge of a square right pyramid of 7′ base, H being the apex of the pyramid. One diagonal of the pyramid's base is in the vertical plane which contains line H K. Draw the pyramid and give the actual distance between the centre of its base and the P.P..

EXERCISE 70. A circle 8′ in diameter touches the G.P. at a point 4′ to the right of the spectator and 4′ within the picture. The circle is contained in a plane which ascends directly from the spectator at an angle of 25° with the G.P., and is one face of a slab 4′ in thickness. Draw the slab.

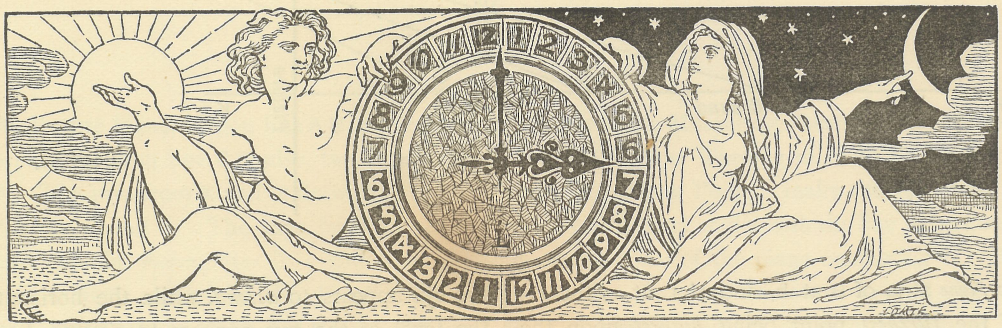
EXERCISE 71. An equilateral, triangular, right pyramid of 7′ base and 11′ axis has its base in a plane ascending directly from the spectator at an angle of 40° with the G.P.. One edge of the base is inclined to the right at an angle of 20° with the Ground Intersection of the Ascending Plane. The apex of the pyramid touches the P.P., and one corner touches the G.P. at a point 2′ to the left of the spectator.

EXERCISE 72. A cube of 6′ edge has one face in a plane which ascends directly from the spectator at an angle of 45° with the P.P.. One edge of the cube is at an angle of 45° with the Ground Intersection of the Ascending Plane. One corner of the cube touches the P.P. at a point 4′ on the spectator's right. One corner touches the G.P.. Upon the nearest face of the cube show a circle 6′ in diameter.

EXERCISE 73. Line A B is 10′ long and vanishes upwards from the spectator at an angle of 45° to the G.P., and is in a vertical plane at an angle of 45° with the P.P. to the left. Its nearer extremity is upon the G.P. at a point 4′ to the right and 3′ within the picture. A B is one diagonal of a square, the other diagonal of which is horizontal. The square is the base of a right pyramid of 10′ axis. Give the actual distance between the apex of this pyramid and a point upon the G.L. directly opposite the spectator.

EXERCISE 74. A regular pentagonal slab having edges of 7′ has one face in a plane which ascends directly from the spectator at an angle of 35° with the G.P.. The nearest corner of the slab is upon the P.P. directly opposite the spectator, another corner being upon the G.P.. One edge of the slab is at an angle of 35° with the Ground Intersection of the Ascending Plane. Thickness of slab 5′.

EXERCISE 75. A square has sides of 100′. It is upon the G.P. with one side vanishing to the left at an angle of 10° with the P.P.. The nearest corner is 5′ to the left of the spectator and 80′ within the picture. This square is the base of a right pyramid having an axis of 70′. Draw the pyramid.



THEORY.

ONE of the first things stated in the beginning of our study was that the Horizontal Line is the Vanishing Line of the Ground Plane (see page 10), that is, the Ground Plane infinitely extended, could only appear to reach the Horizontal Line, and as no part could appear above the Horizontal Line, the plane is said to vanish there. It is indeed a truth that *all* horizontal planes vanish in the Horizontal Line.

Referring to Fig. 23, we find the *Picture Plane,* the Eye, and three horizontal planes, marked H I K, 2, and X 3 Z, the first being the *Ground Plane.* These are all shown in side elevation.

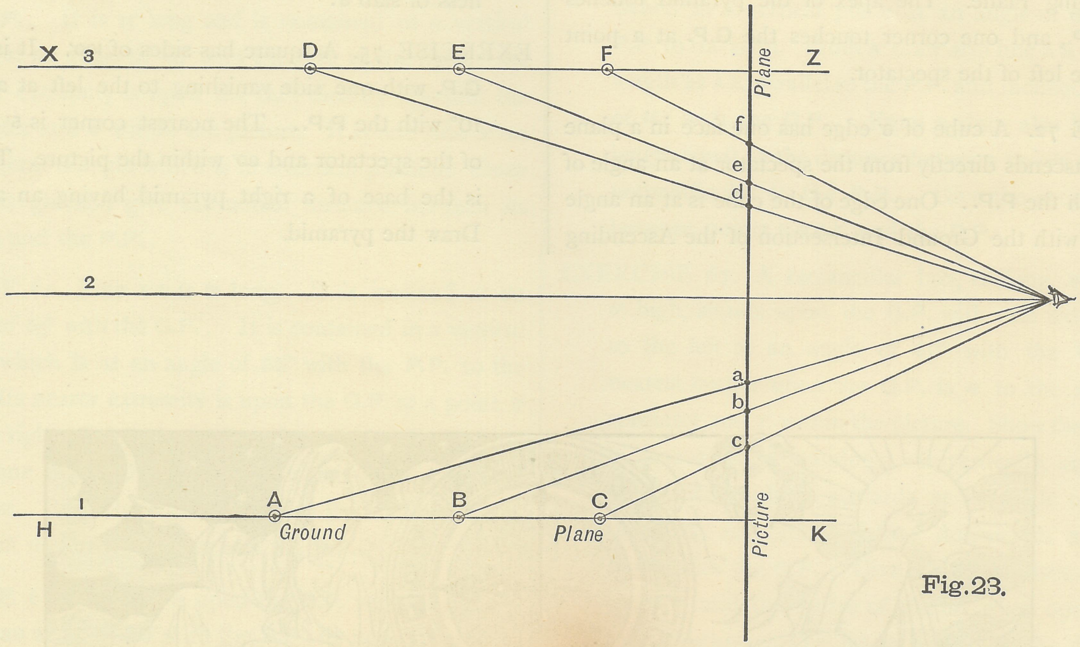


Fig.23.

Three points, A, B, and C, are marked upon the *Ground Plane,* and three points, D, E, and F, are marked upon plane X 3 Z. Drawing the rays from points A, B, and C, to the Eye, we find the portion of the *Ground Plane* marked A represented upon the *Picture Plane* at a, of B at b, and of C at c, the representation of the *furthest* point being *highest* upon the Picture Plane. Thus, as the *Ground Plane* retires, it appears to approach the central position opposite the eye (see page 10). The same is also equally true of plane X 3 Z above the level of the Eye, points D, E, and F having their representations upon the Picture Plane in d, e, and f, while the plane marked 2 is seen merely as a line at the level of the spectator's Eye. Thus the horizontal plane *below* the level of the eye appears to *ascend,* while the horizontal plane *above* the level of the eye appears to *descend,* both of them approaching the level of the Eye. If the two planes are produced infinitely and the same process repeated, viz. points marked on each plane, and visual rays drawn from the points to the eye, as the points recede from the Picture Plane the visual rays will more closely approach the central position; and, could the planes be produced far enough, the visual rays would ultimately appear to coincide with the Central Visual Ray. Therefore the Vanishing Line of all horizontal planes will be the Horizontal Line.

In like manner all Vertical Planes at right angles to the Picture Plane appear to vanish in a Vertical line passing through the Centre of Vision.

Referring again to Fig. 23, let us consider the Picture Plane, Eye, and the three planes to be viewed, in *plan*, the three planes now becoming vertical planes at right angles to the Picture Plane. By going through the same process as before, it will be seen that as the planes X3Z and HIK retire, they appear to approach the central position.

We may then consider the theoretical truth established, that *all horizontal planes appear to vanish in the Horizontal Line*, also that *all vertical planes at right angles to the Picture Plane vanish in the Central Vertical Line.*

It may also be noted that all planes (whether vertical or inclined) at right angles to the Picture Plane, will have their Vanishing Lines passing through the Centre of Vision.

Turning to page 12, our first proposition says that all real measurements must be made upon the Picture Plane. The truth of this will be evident on reference to Fig. IV., Plate I., from which we may deduce the fact that a measurement of say 1′ at a distance of 3′ from the Picture Plane would *appear* less than its real size. It would therefore give a false result if we made a real measurement, within the picture.

Our second proposition (see page 12) states that lines which are at right angles to the Picture Plane vanish in the Centre of Vision.

In Fig. 24 we have a ground plan of the *Picture Plane*, the position of the spectator, and two lines AB and CD, at right angles to the Picture Plane. Upon line AB, two points are marked X and Z. Upon line CD also, two points are marked V and W. The rays from X and Z drawn to the eye cut the *Picture Plane* in x and z. The rays from V and W drawn to the eye cut the *Picture Plane* in v and w. The *Central Visual Ray* is at right angles to the Picture Plane. Therefore as the representations of lines AB and CD are seen to continually approach the *Central Visual Ray*, which passes through the Centre of Vision, but both lines being parallel to the *Central Visual Ray*, the rays drawn from the lines to the eye can never go beyond it, lines at right angles to the *Picture Plane* will have their Vanishing Point in the Centre of Vision.

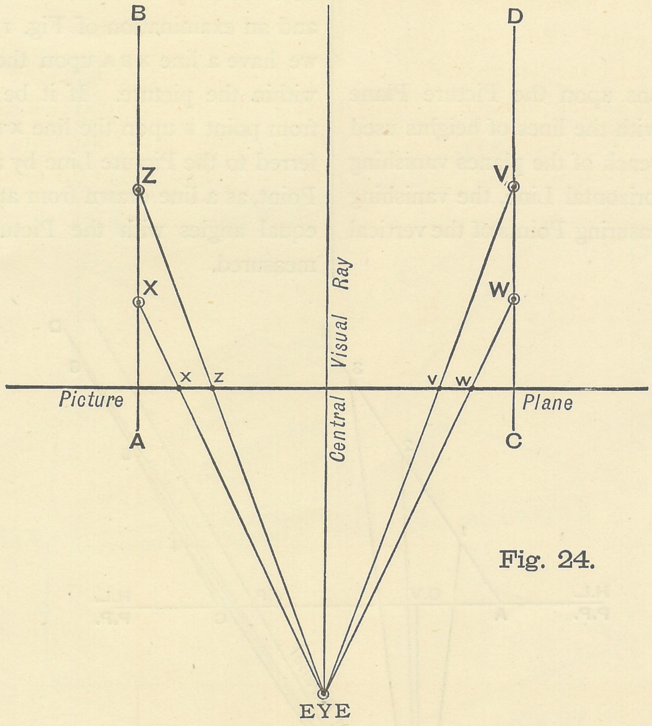


Fig. 24.

Our third proposition (see page 12) says that the Point of Distance is the Measuring Point for lines which vanish in the Centre of Vision. Turning to Plate XXIV. we find it proved that a Measuring Point is really the Vanishing Point of lines which make equal angles with the line to be measured and the intersecting line of the plane containing it. By joining the eye to the Point of Distance we find that its Vanishing Parallel is at an angle of 45° with the Picture Plane. Then lines drawn to the Point of Distance are at angles of 45° with the Ground Line, and consequently also at angles of 45° with lines at right angles to the Picture Plane, therefore lines which vanish in the Centre of Vision are measured by lines which vanish in the Point of Distance.

Our fourth proposition (see page 12) says that any point upon the Horizontal Line may be used as a measuring point for vertical lines. The reason for this is that all vertical planes passing through and limited by the same vertical line must be equal, and coming in contact with the Picture Plane will have vertical intersections of equal magnitudes (see Fig. 25). XZ is a vertical line, X being upon the Ground Plane. AB, V.I., and CD, V.2., are two vertical planes passing through XZ. Their vertical intersections upon the Picture Plane AB and CD, which correspond with the lines of heights used in working, are of equal length, each of the planes vanishing to different points upon the Horizontal Line, the vanishing points V.I. and V.2. being the Measuring Points of the vertical line XZ.

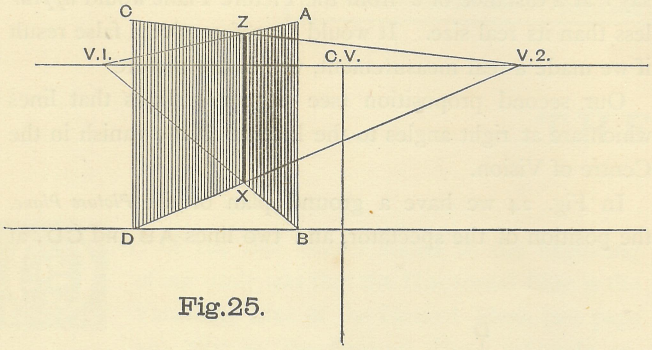


Fig.25.

This will also be found to bear out the fact referred to in Plate XXIV., page 64, viz. that a Measuring Point is a Vanishing Point of lines which make equal angles with the line to be measured and the Intersecting Line of the plane containing it. Thus, in Fig. 25, if we take plane AB, V.I., AB is the Intersecting Line. It is vertical. XZ is the line to be measured. It is also vertical. Lines B V.I., A V.I. are horizontal, therefore they make equal angles with the line to be measured and the Intersecting Line of the plane containing it.

Our fifth proposition (see page 12) states that when the extremity of the line to be measured is within the picture, it must be transferred to the Picture Plane from its measuring point. As Proposition I. shows that all real measurements must be made upon the Picture Plane it is clear that the extremity must be transferred to the Picture Plane.

That it must be transferred from its Measuring Point will be evident by a reference to the explanation of Proposition 3 and an examination of Fig. 1, Plate XXIV., in which figure we have a line XBA upon the Ground Plane, point B being within the picture. If it be required to measure a length from point B upon the line XBA, the point B must be transferred to the Picture Line by a line drawn from its Measuring Point, as a line drawn from any other point would not make equal angles with the Picture Line and the line to be measured.

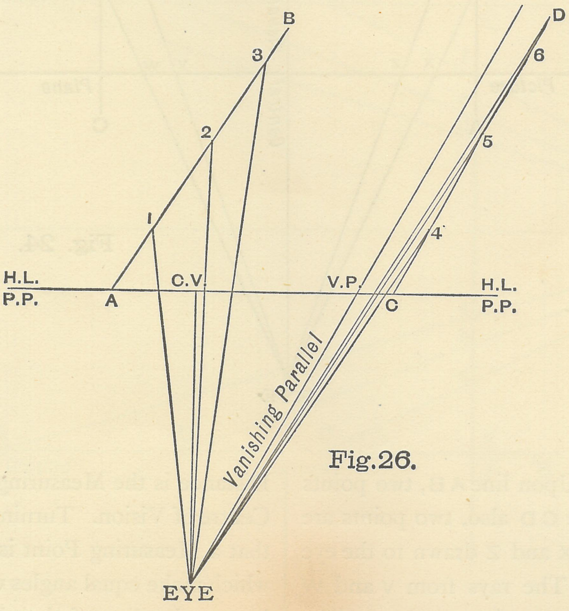


Fig.26.

Our sixth proposition (see page 14) says that to find the Vanishing Point of a horizontal line, a line must be drawn from the eye to meet the Horizontal Line, parallel to the line whose Vanishing Point is required. On reference to Fig. 24 it will be seen that the *Central Visual Ray* is the Vanishing Parallel of lines at right angles to the *Picture Plane.* In Fig. 26 we have the same principle illustrated by means of a line inclined to the Picture Plane. The Picture Plane, two lines AB and CD, their *Vanishing Parallel,* and the EYE are seen in *plan.* In this figure as in Fig. 1, Plate II., the H.L. represents the Picture Plane seen in plan. A careful comparison of this figure with Fig. 24 will be all required to clearly show the truth of the proposition.

Our seventh proposition (see page 14) is to the effect that to find a Measuring Point we must set off upon the Vanishing Line of a plane, the length of the Vanishing Parallel. As this process gives upon the Vanishing Line a Vanishing Point of lines making equal angles with the line to be measured to the Intersecting Line of the plane containing it, and has been explained (see Fig. 1, Plate XXIV.) in the foregoing demonstrations, further explanation will be unnecessary.

Our eighth proposition (see page 14) states that lines which are parallel vanish to the same point. The truth of this proposition, if not already realised, will be made manifest by a reference to Fig. 24.

Our ninth proposition (see page 50) says that to find the Vanishing Point of an inclined line we must draw from the Original Measuring Point to meet the Vertical Vanishing Line, a line parallel to the line whose Vanishing Point is required.

We have seen that Vertical planes at right angles to the Picture Plane have their Vanishing Lines passing vertically through the Centre of Vision. In like manner the Vertical Vanishing Lines of Vertical Planes making other angles with the Picture Plane will be on the right or left of the Centre of Vision as the case may be.

Thus, if a line incline upwards or downwards to the right, the Vertical Vanishing Line upon which it will vanish will be on the right; and if the line incline to the left, the Vertical Vanishing Line will be on the left.

This will be easily seen by reference to Figs. 23 and 26.

In Fig. 27 we have the Picture Plane, XYZ, and the Ground Plane HKYZ. A triangle ABC stands upon the Ground Plane in a vertical position, side AB being inclined to the Ground Plane.

The eye is shown in its real position in front of the Picture Plane, and the *V.V.L.* of the *Vertical Plane* containing *A B*, with its *Horizontal Vanishing Parallel* giving the *O.V.P.* upon the Horizontal Line. The real Vanishing Parallel of A B is drawn actually parallel to A B.

The distance between *O.V.P. of Vertical Plane containing A B* upon the Picture Plane and *O.M.P. of Vertical Plane containing A B* upon the Picture Plane is, in actual problem made *equal to the distance between the eye and O.V.P. upon the Picture Plane.*

Therefore a line drawn from *O.M.P. making the same angle with the Horizontal Line as is made by the real Vanishing Parallel and the Horizontal Vanishing Parallel,* will give the true position of the *A.V.P.*.

The tenth proposition (see page 50) refers to the position of an Accidental Measuring Point. This will need no explanation as the principles governing it have been fully discussed in the preceding demonstrations.

The Vanishing Line of a Direct Ascending Plane is determined by the intersection with the Picture Plane of a plane passing through the spectator's eye at an angle with the Ground Plane equal to that made by the Direct Ascending Plane. In a similar way the Horizontal Line is the intersection of the Picture Plane with a plane passing *horizontally* through the spectator's eye.

We are now conversant with the elementary points connected with the theory of linear perspective, and should be able to easily grasp the principles governing shadows and reflections, to be considered in our next Part.

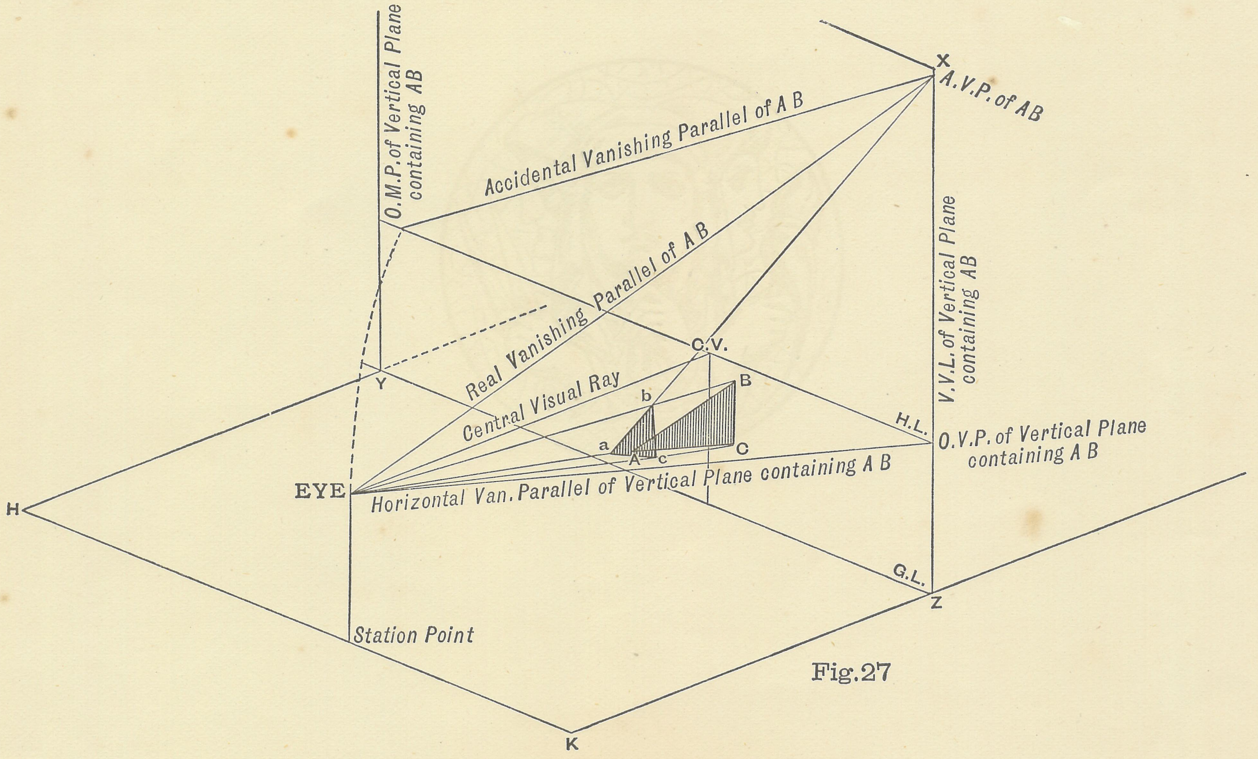

O.M.P. of Vertical Plane containing AB
X
A.V.P. of AB
Accidental Vanishing Parallel of A B
Real Vanishing Parallel of A B
V.V.L. of Vertical Plane containing AB
C.V.
Y
B
b
Central Visual Ray
H.L.
O.V.P. of Vertical Plane containing A B
a
A
c
C
EYE
Horizontal Van. Parallel of Vertical Plane containing A B
H
G.L.
Z
Station Point
K

Fig.27

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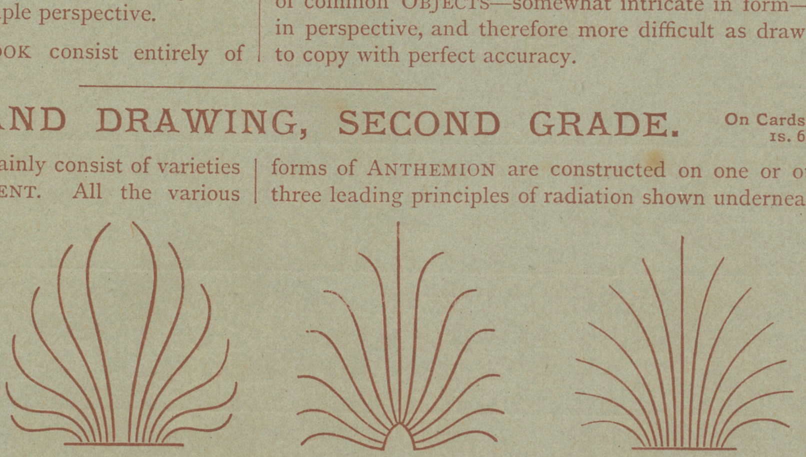
Honeysuckle.



[*Construction of the Various Forms of Anthemion Ornament.*]

(No. 1.) (No. 2.) (No. 3.)

No. 1 alone is founded on the true honeysuckle form.

No. 2 is a modification of No. 1, obtained by reversing the lines of the form.

No. 3 is the foundation of the Antefix of the Parthenon, and seems adapted from a shell form. Others are combinations of these various forms, or are adapted from the growth of plants, such as the palm or palmetto.

The Second Book contains further examples of the Anthemion Ornament and some examples of Italian Renaissance, from the South Kensington Museum.

The Examples in the Third Book are from Architectural Ornament of the Italian Renaissance. The capitals from the *Castello di Mondolfo, near Fano, in Umbria* (the originals of which are in the South Kensington Museum), are remarkable for the variety of invention and great freedom of execution, combined with exquisite finish. These beautiful carvings are in a perfect state of preservation, and form excellent studies of style. They have never before been engraved.

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7 Anthemion—Ancient Greek.
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15 Anthemion—Ancient Greek.
16 Anthemion—Ancient Greek.
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18 Venetian Glass Tazza, 16th century.

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19 Frieze in the style of the Lombardi.
20 Foliated Anthemion.
21 Foliated Anthemion.
22 Central Portion of an Italian Capital.
23 Italian Capital, about 1490 (Mondolfo).
24 Do. do. do.
25 Italian Capital, about 1490 (Mondolfo).
26 Arabesque decoration of a Panel.
27 Portion of a Panel by the Lombardi.

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28 Roman Dish found at Hildesheim
29 Old Japanese Bronze Flower Vase.
30 Patera, Tomb of the Scipios, Rome.
31 Italian Capital, 16th century.
32 Old Japanese Bronze Candlestick.
33 Enamelled Venetian Dish.
34 Viola da Gamba, 17th century.
35 Do. do. (another view).
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15 The Venus of Arles—Full View.
16 The Venus of Melos—Three-quarter View.
17 The Apollo Belvedere—Full View.
18 The Apollo Belvedere—Profile.

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20 Colossal Hand, by Michelangelo.
21 Colossal Hand, by Michelangelo.
22 Hand of the "Faun"—Antique.
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24 Hand of the "Cupid," by Michelangelo.
25 Hand of the Virgin, by Michelangelo.
26 Hand with a Scroll.
27 Hand, by Michelangelo.

BOOK IV.—Feet, from Sculpture.

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29 Foot of the Farnese Hercules.
30 Foot of the Apollius.
31 Foot of the Hermes—Side View.
32 Foot of the Hermes—Front View.
33 Foot of the Hermes—Side View.
34 Sole of an Adult Foot.
35 Foot of the Farnese Hercules (Front).
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